were still single, but two days later these were strongly doubled, while on March 30th they were found to be triple, the more refrangible component in each case having separated into two.

The hydrogen bright bands and some of the others showed considerable structure, but the band at 465 was usually hazy and shapeless, and was crossed here and there by dark bands.

Early in May the bright bands characteristic of the nebular spectrum began to appear. On the second of that month none of these except possibly 5007A was photographed, while on the ninth 5007A and 4959A were strongly recorded on a photograph of the visual region. A spectrogram of the photographic region made on May 12th showed 4363A, 4959A and 5007A bright. The earlier spectrogram, that of May 9th, did not include the position 4363A, so that it may be assumed that the line of this wave-length was present on that date.

The last photograph of the series was secured on May 27th. The plate is a little weak on account of the low altitude of the star at that time. The nebular lines are present on this spectrogram, but are not appreciably stronger than on the 12th of the month.

NOTE ON THE PLANETARY NEBULÆ.

By H. D. Curtis.

These objects form a very interesting subdivision of the great nebular class. Though sharply separated from the spiral "white" nebulæ in general form and in spectrum, some confusion arises when the attempt is made to define exactly those qualities which entitle a nebula to the name "planetary." A typical planetary nebula is relatively small, its outer boundaries are very distinct and clearly marked, there being no gradual falling off at the edges, but instead a very abrupt boundary line. They are generally very bright, and for some of them an exposure of ten seconds with the Crossley reflector is ample to show the central star, which almost always exists in this type, and the surrounding nebulosity.

Some larger nebulæ have been included in this class, such as

the "Dumb-bell" and "Owl" nebulæ. They are, however, very much less brilliant than the typical planetary, more irregular in shape, and particularly the material forming the disk is much more patchy and irregular. They possess many points of resemblance, it is true, but it is doubtful whether they are properly to be included in the class of typically planetary nebulæ.

From an evolutionary standpoint, the planetary nebulæ form an interesting sub-class. Are we to suppose that they have been formed by gradual condensation from a much more widely extended nebular mass, or have the causes which produced them proceeded from within outward? If the former were the case, it would be highly probable, though not necessarily true, that we should find outlying wisps of the parent nebulosity. To the best of my knowledge, most photographs which have been made of these typical planetaries with powerful instruments have been of very short exposure times, this being all that was necessary to show their structure; with a long exposure, so brilliant are these objects actinically, all details are burnt out.

To test this point, I have made exposures of from two to three hours on a number of the typical planetary nebulæ with the Crossley reflector. This should be ample to show any faint outlying masses of nebular matter.

The following planetaries have been observed:—

N.G.C.	α	δ	Description
6210	$16^h\ 40^m$	$+\ 23^\circ\ 59'$	Has faint ansæ on each side in which two faint knots or stars are involved; this is probably a ring. The central mass is roughly prolate with regard to these ansæ. No other outer nebulosity.
6543	17 58	+ 66 38	No outer nebulosity.
6572	18 7	+ 6 50	No outer nebulosity.
6781	19 14	+ 6 21	No extensions; round, faint, patchy disk and ring stronger on one side; not a "typical" planetary.
6826	19 43	+ 50 17	Very bright and sharply marked; slightly oval; no traces of extensions.
6905	20 18	+ 19 47	Faint, short, ansa in which small star is involved; no other outer nebulosity.
7009	20 58	— 11 48	Saturn shaped; both disk and ansæ very bright and sharply defined; no outer nebulosity.
7026	21 3	+ 47 27	Binuclear; with long exposure details are burnt out; brighter part appears almost square, with irregular extensions which suggest a ring; no distant remnants of nebulosity.
7027	21 3	+ 41 50	Binuclear; no extended outer nebulosity, but some evidence of ring formation in *ansa* on one side.

N.G.C.	α	δ	Description
7354	22 37	+ 60 46	An irregular oval ring with fainter material in disk outside and within the ring; has central star. No outer nebulosity.
7662	23 21	+ 41 59	Very bright and sharply defined. Oval, with very minute projections like ansæ. No traces of outer nebulosity.

So far as this list goes, then, the evidence is strong that the "typical" planetary nebula is self-contained, without outlying remnants of nebulosity, except in the frequent occurrence of *ansæ,* which may indicate Saturn-like rings.

PLANETARY PHENOMENA FOR SEPTEMBER AND OCTOBER, 1912.

By Malcolm McNeill.

PHASES OF THE MOON, PACIFIC TIME.

Last Quarter	Sept. 4,	5h 23m	A.M.	Oct. 3,	12h 48m P.M.
New Moon	" 10,	7 48	P.M.	" 10,	5 41 A.M.
First Quarter	" 17,	11 55	P.M.	" 17,	6 6 P.M.
Full Moon	" 26,	3 34	A.M.	" 25,	6 30 P.M.

The third of the eclipses of the year will occur on the night of September 25th-26th. It is a partial eclipse of the Moon and will be visible generally throughout the United States. The circumstances of the eclipse are as follows:—

Moon enters penumbra	Sept. 26,	1h 15m A.M.	Pacific time
Moon enters shadow	" 26,	3 3 A.M.	" "
Middle of eclipse	" 26,	3 45 A.M.	" "
Moon leaves shadow	" 26,	4 26 A.M.	" "
Moon leaves penumbra	" 26,	6 14 A.M.	" "

The maximum obscuration is only about one eighth of the Moon's diameter.

The fourth and last eclipse of the year is a total eclipse of the Sun on October 10th. It will not be visible in the United States, except in the extreme southeast, where it may be seen as a very small partial eclipse just after sunrise. The line of totality runs across South America from Equador, through Brazil and ends about half-way between Madagascar and the south pole. The maximum duration of totality is a little less than two minutes.